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IS 3600-7 (1985): Method of Testing Fusion Welded Joints and Weld Metal in Steel, Part 7: Longitudinal root and face bend test on butt welds [MTD 11: Welding General]

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“Knowledge is such a treasure which cannot be stolen”



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*Indian Standard*

**METHOD OF TESTING FUSION WELDED JOINTS
AND WELD METAL IN STEEL**
**PART 7 LONGITUDINAL ROOT AND FACE BEND
TEST ON BUTT WELDS**
(Second Revision)

1. Scope — Specifies two methods for making longitudinal root and face bend tests on test pieces taken from a fusion welded butt joints in order to assess ductility or absence of defects on the surface in tension of the joint itself. It also gives the dimensions of the test piece.

2. Field of Application — This standard applies to ferrous materials with butt joints made by any fusion welding process.

3. Principle

3.1 Submitting a test piece, taken longitudinally from a welded joint, to plastic deformation by bending it, without reversing the bending direction, in such a way that one of the surfaces of the weld is in tension.

3.2 The test may be made according to either of two methods described in 6 (bending test using a former) and 7 (bending test using a roller).

4. Taking of Test Piece

4.1 The test piece shall be taken from a part of a welded fabrication or a welded test assembly longitudinally to the welded joint in such a way that after machining the weld axis will be parallel to the length of the specimen.

Note — "Test assemblies" are welded joints which do not belong to a construction but are made for purposes of approval (for example, procedure qualification), control (for example, production test coupons) or studies and research.

4.2 Each test piece shall be marked in such a way that after its removal it is possible to identify its exact position in the fabrication or in the test assembly from which it has been taken. No heat treatment shall be applied to the test assemblies unless it is specified or allowed by the application standard for the welded joint to be tested. Details of any heat treatment shall be recorded in the test report.

4.3 The test piece shall be taken by appropriate means. Shearing is excluded for thicknesses of more than 8 mm. If thermal cutting or other methods which could affect the cut surfaces are used, the cuts shall be at a distance from the test piece greater or equal to 8 mm, but in any case sufficient according to the process used, not to induce alterations which could modify the test results. An exception to this may be the case when the bend test is made only to ascertain the possible presence of weld defects, in which case the edges of the specimen shall be dressed smooth.

5. Machining of the Test Piece

5.1 The test piece shall be finished by machining or grinding, suitable precautions being taken to avoid superficial strain-hardening or excessive heating of the material. Within the length L (see 6.3) the surfaces shall be free from scratches or notches.

5.2 The test piece shall have a rectangular cross-section practically constant for all its length. The cross-sectional shape and dimensions shall conform to Fig. 1. The length of the specimen shall be such that it will satisfy the specified test requirements.

When the weld is made from one side only, the bend test pieces are called:

- a) face bend test pieces, when the surface in tension contains the largest width of the weld; and
- b) root bend test pieces, when the surface in tension contains the root of the weld.

When the joint is made from both sides, then the side from which welding commenced first is called the face. The other side is called the root.

5.3 The upper and lower surfaces of the weld shall be dressed flush with the original surfaces of the parent metal. Machining of the undercuts is not permitted, unless otherwise specified in the application standard.

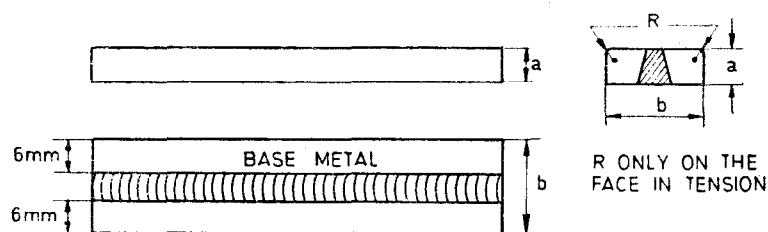


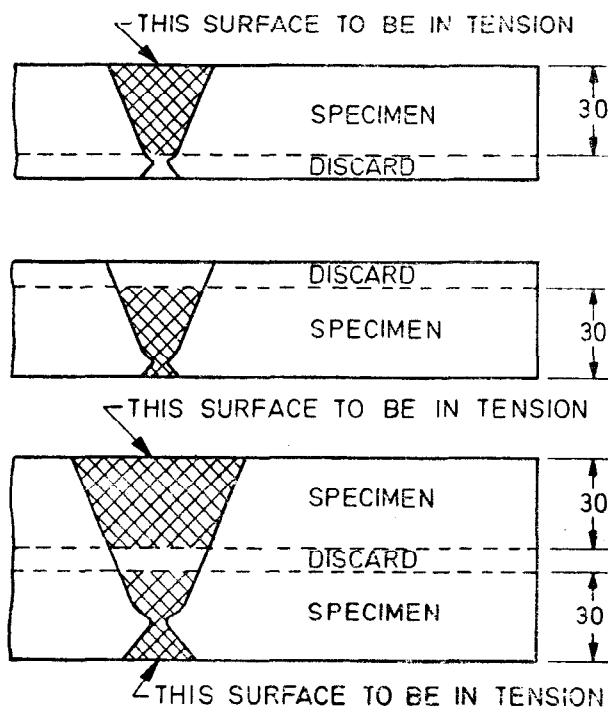
FIG. 1 DIMENSIONS AND SHAPE OF TEST PIECE

5.4 Generally the test piece thickness a shall be equal to the thickness of the parent metal near the welded joint.

When the joint thickness exceeds 30 mm, it is permissible, instead of a single test piece having the full joint thickness, to take several test pieces from the welded joint, provided the thickness a of each test piece is not less than 30 mm and that they cover the full thickness of the joint (see Fig. 2). In such a case the position of the test piece in the welded joint thickness shall be identified.

Note — A reduced number of test pieces or test pieces taken in different positions may be required by the application standard concerning the welded joint to be tested.

5.5 The corners of the test piece on the face in tension shall be rounded by filling or grinding to a radius R not exceeding $0.2 a$ (maximum 3 mm).



All dimensions in millimetres.

FIG. 2 METHODS OF CUTTING TRANSVERSE OR LONGITUDINAL BEND TEST SPECIMENS FROM FULL PLATE THICKNESS

6. Method for Bend Testing Using a Former (see Fig. 3)

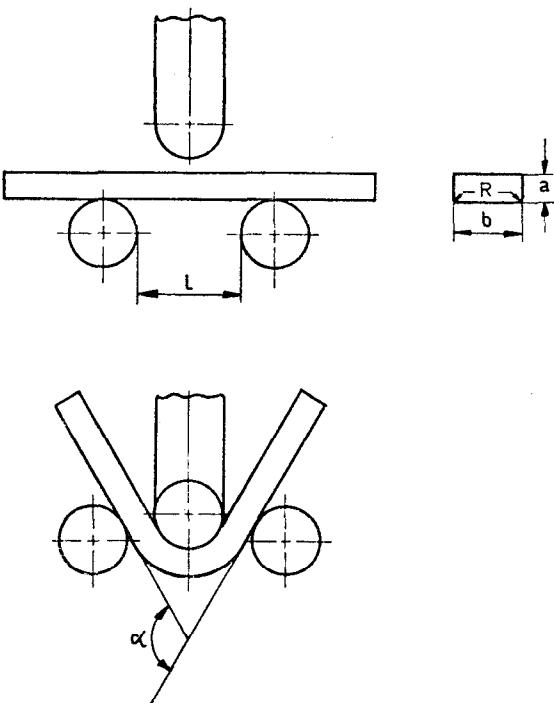


FIG. 3 BEND TEST METHOD USING A FORMER

6.1 The test shall be carried out by placing the test piece on two supports consisting of parallel rollers. The test piece shall be slowly and continuously bent by applying in the middle of the span, a concentrated load (three point bending) perpendicularly to the test piece surface.

6.2 The load shall be applied by means of a former having an end diameter D that conforms to the requirements of the application standard concerning the welded joint under examination.

6.3 The distance L (see Fig. 3) between rollers shall be not greater than $L = D + 3a$.

6.4 The test is completed when the bending angle α (see Fig. 3), reaches the value given in the application standard concerning the welded joint under examination.

7. Method of Bend Testing Using a Roller (see Fig. 4)

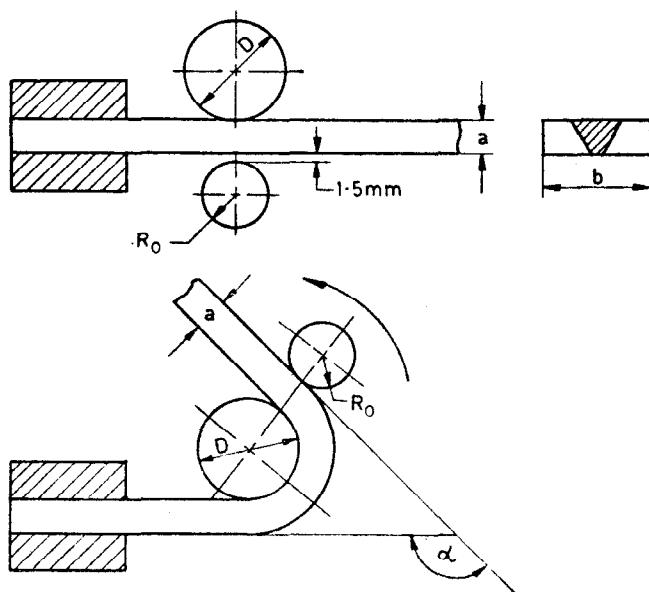


FIG. 4 BEND TEST METHOD USING A ROLLER

7.1 The test shall be carried out by firmly clamping one end of the test piece in a testing device having two parallel rollers.

The test piece shall be slowly and continuously bent by applying a concentrated load on the test piece by means of the rotation of the outer roller, having a radius R_o , through an arc centred on the axis of the inner roller.

7.2 The diameter D of the inner roller shall conform to the requirements of the application standard concerning the welded joint under examination.

7.3 The test is completed when the bending angle α (see Fig. 4) reaches the value given in the application standard concerning the welded joint under examination.

8. Results

8.1 After bending, both the external surfaces and the sides of the test piece shall be examined.

8.2 The evaluation of the bent test piece shall be made in accordance with the appropriate application standard for the welded joint under examination.

8.3 In the test report the method of bending shall be recorded.

E X P L A N A T O R Y N O T E

This standard was first published in 1966 and subsequently revised in 1973 covering various tests on fusion welded joints and weld metal in steel. In view of the experience gained and in order to bring the test and test requirements in line with other international standards published so far, it has been decided to revise the standard in the following parts:

- Part 1** Cruciform fillet weld-tensile test
- Part 2** Beam impact (Charpy V-notch) test
- Part 3** Transverse tensile test on butt welds
- Part 4** Longitudinal tensile test on cylindrical weld metal test pieces on butt welds
- Part 5** Transverse root and face bend test on butt welds (corresponding to ISO 5173-1981)
- Part 6** Transverse side bend test on butt welds (corresponding to ISO 5177-1981)
- Part 7** Longitudinal root and face bend test on butt welds
- Part 8** Nick break test and fillet weld fracture test
- Part 9** Macro and micro examination.

In this revision free bend test has been deleted as the ductility of the weld zone is being assessed more and more by other bend tests. Special tests such as tests for the susceptibility to lamellar tearing, reheat cracking, brittle fracture and creep fatigue will be covered in separate standards.

The main purpose of this standard is to recommend test procedures and test specimens that should be quoted or incorporated in engineering application standards that deal with welded constructions primarily for the qualification of welding procedures and operators. Where differences still exist between application standards, the methods of test given in this standard should be preferred.

A general indication is given of the purpose served by the tests specified in this standard, but this standard does not indicate the choice of test method nor a particular application nor the number of specimens to be tested or the repeat tests to be allowed in the event of failure. Such requirements are matters to be dealt with in the particular application standards where they exist or to be agreed between the manufacturer and the purchaser.

It should be realized that variations in welding procedure and the preparation of test specimens can give rise to variations in the test results.

In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2-1960.